GEOTECHNICAL ENGINEERING INVESTIGATION
PREDA STREET PIPELINE BRIDGES UPGRADE PROJECT
SAN LEANDRO, CALIFORNIA

For

CITY OF SAN LEANDRO
835 East 14th Street
San Leandro, CA 94577

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GEOTECHNICAL ENGINEERING INVESTIGATION
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SAN LEANDRO, CALIFORNIA

INTRODUCTION

This report presents the results of our geotechnical engineering investigation for the proposed Preda Street Pipeline Bridges Upgrade Project in the City of San Leandro, California. Our work was performed generally in accordance with the scope of work as per our agreement. The general location of the site and its vicinity are shown on the Project Location Map, Plate 1.

The geotechnical recommendations presented in this report are intended for design input and are not intended to be used as specifications. These recommendations should not be used for direct bidding purposes.

PURPOSE AND SCOPE

The purpose of this investigation was to evaluate the general soil conditions and to evaluate their engineering properties for the proposed project. The scope of work performed for this investigation included a review of the readily available soils and geologic literature pertaining to the site, obtaining representative soil samples and logging soil materials encountered in two drilled borings, laboratory testing of the collected samples, engineering analysis of the field and laboratory data, and preparation of this report. The basis for this investigation is a set of as-built plans provided to us by the City. We have presented the Site Plan on Plate 2 and descriptive log of the boreholes in Appendix A.

Due to limitations inherent in geotechnical investigations, it is neither uncommon to encounter unforeseen variations in the soil conditions during construction nor is it practical to determine all such variations during an acceptable program of drilling and sampling for a project of this scope. Such variations, when encountered, generally require additional engineering services to attain properly constructed project. We, therefore, recommend that a contingency fund be provided to

accommodate any additional charges resulting from technical services that may be required. Our recommendations in this report are based on the above information. Any major deviation should be reported to this office for consideration.

SITE CONDITIONS

The project site is located near the north end of Preda Street (Alder Creek Circle) in San Leandro. The two 16-inch diameter pipes are supported on two independent single-span steel truss structures, spanning approximately 80 feet, over San Leandro Creek. The existing bridges were built in 1938 and 1974, respectively. Both structures are supported on concrete piers with shallow spread footings (4 feet × 5 feet).

The area is generally residential at the southern end of the project, and Union Pacific Railroad is located approximately 50 feet north of the existing structure. It is highly vegetated along the slope on both sides of the creek. Based on the plans and the survey data provided, the lowest part of San Leandro Creek appears to be at approximately Elev. 15 feet within the project vicinity.

FIELD EXPLORATION

Based on the plans, and readily available data of the area, two exploratory borings were drilled to a maximum depth of 31.5 feet below the existing ground surface. The locations and description of the materials are shown on the Site Plan, Plate 2 and Appendix A of the report.

Due to the sloping ground condition and limited access, the test borings were advanced with a portable minute-man drill rig using solid stem augers. Selected samples were obtained from 2.5-inch I.D. (Modified California) and 1.4-inch I.D. (Standard Penetration) samplers at various depths. The samplers were driven into subsurface soils under the impact of a 140-pound hammer

having a free fall of 30 inches. The blow counts are presented on the "Log of Test Borings". (When correlating standard penetration data in similar soils, the blow counts for the Modified California Sampler can be taken as roughly twice that for the Standard Penetration Test in similar soils). The samples were sealed and transported to our laboratory for further evaluation and testing. The field investigation was conducted under the supervision of our field engineer who logged the test borings and prepared the samples for subsequent laboratory testing and evaluation.

Laboratory tests were performed on selected samples during field exploration to determine the physical and engineering properties of the subsoils. Laboratory data of moisture contents, dry density and unconfined compression tests are presented on the Log of Test Borings.

The bore logs presented in Appendix A were prepared from the field logs which were edited after visual re-examination of the soil samples in the laboratory and results of classification tests on selected soil samples as indicated on the logs. The abrupt stratum changes shown on these logs may be gradual and relatively minor changes in soil types within a stratum may not be noted on the logs due to field limitations.

SUBSURFACE CONDITIONS

Based on the boring drilled in November 2007, the subsoils generally consist of alluvial materials. Boring B-1, drilled near the north abutment, encountered predominantly stiff to hard lean clay with 1.5-foot-thick silty sand lens at approximately 10 feet depth. Boring B-2, drilled near the south abutment, encountered approximately 10 feet of granular materials and 7.5 feet of fat/lean clay, overlying silty sand to 28.5 feet depth. Below the previous depth, lean clay was encountered at the bottom of the hole to 31.5 feet, the maximum depth drilled.

Groundwater was encountered at approximately 19.5 and 12.5 feet below existing ground surface in Borings B-1 and B-2 during exploration, respectively. The groundwater level is anticipated to vary with the passage of time due to seasonal groundwater fluctuation, surface and subsurface flows, ground surface run-off, water level in San Leandro Creek and other factors that may not be present at the time of investigation. We have assumed groundwater at Elev. 20 feet for design purpose.

GEOLOGY

General geologic features pertaining to the site were evaluated by reference to the Quaternary Geology and Liquefaction Susceptibility Maps, San Francisco, California, by Keith L. Knudsen, Jays S. Naller, Janet M. Savers & William Lettis & Associates (USGS Open-File Report 97-715, Sheet 1 of 2, 1997). Based on the publication, the site is generally underlain by alluvial fan deposits (Qhf, Holocene), which is characterized mainly by sand, gravel, silt, and clay, and moderately to poorly sorted, and moderately to poorly bedded. A geologic map of the project vicinity is shown in Plate 3.

EARTHQUAKE CONSIDERATIONS

Seismic Sources

The project site is located in a seismically active part of northern California. Many faults exist in the San Francisco Bay Area, which are capable of producing earthquakes and may cause strong ground shaking at the site. The governing fault at the site is the Hayward Fault, located at about 2 miles (3.2 km) from the site.

Seismic Hazards/Liquefaction Impact

Potential seismic hazards may arise from three sources: surface fault rupture, ground shaking and liquefaction. Since no active faults pass through the site, the potential for fault rupture is relatively low. Based on available geological and seismic data, the possibility of the site to experience strong ground shaking may be considered moderate to high.

Liquefaction is a phenomenon in which saturated cohesionless soils are subject to a temporary but essentially total loss of shear strength under the reversing, cyclic shear stresses associated with earthquake shaking. Submerged cohesionless sands and silts of low relative density are the type of soils, which usually are susceptible to liquefaction. Clays are generally not susceptible to liquefaction. Based on the boring data, the submerged sand lenses encountered in the two borings may be subject to liquefaction during a strong earthquake. The thickness of liquefiable sand lenses are relatively minor (approximately 1½ feet per Boring B-1 and 2~3 feet per Boring B-2). Therefore, surface manifestation of ground failure might not be anticipated. The extent and consequences of this liquefaction, in our opinion, could be limited to some post-liquefaction settlements of the ground surface. It is estimated that the post-liquefaction settlements may be on the order of 0.5 inch, and probably would be random and localized. Liquefaction was considered for foundations evaluation of the proposed project. In our opinion, we do not anticipate significant impact on the design due to liquefaction.

FINDINGS AND RECOMMENDATIONS

General

Based on the findings of our investigation, we have summarized the analysis results in the following sections. This report was prepared specifically for the proposed project. Normal construction procedures were assumed throughout our analysis and represent one of the bases of

recommendations presented herein. Our design criteria have been based upon the materials encountered on the site. Therefore, we should be notified in the event that these conditions are changed, so as to modify or amend our recommendations.

Foundations

Based on the as-built plans provided, both of the existing steel structures consist of three supports. Piers 1 and 2 are concrete piers of 4 feet wide and 5 feet long, and Pier 3 is 2¾ feet wide and 3¾ feet long for both structures. Based on the boring data and as-built plans, Pier 1 at the south abutment are embedded in medium dense silty sand, and the bottom of the footing is approximately 2.5 feet below existing grade; Piers 2 and 3 at the north abutment are embedded in stiff clay, and the bottom of the footing is approximately 4 feet below grade. The boring data indicate stiff clay at the footing subgrade at all supports. The estimated allowable bearing capacities are 2500 psf for Pier 1, and 3000 psf for Piers 2 & 3 of both steel structures. For seismic loading conditions, the ultimate bearing capacity can be considered three times the allowable value.

A coefficient of friction of 0.3 can be used between the footing and subgrade to provide lateral resistance. In addition, Equivalent Fluid Pressure (EFP) of 360 pcf may be applied for Pier 1 at the south abutment, and a uniform passive resistance of 4 ksf may be used for Pier 2 and 3 at the north abutment to provide lateral resistance against the side of the pier for ultimate seismic loading conditions. We have assumed that the backfill around the footing was well compacted. Caltrans guidelines for investigations and reports (September, 2000) indicate that sliding resistance shall be calculated using either 50% of base resistance plus 50% of passive resistance behind the footing or 100% of base resistance only or 100% of passive resistance only.

Lateral Deformation of the Piers

The footings may experience lateral loading conditions along transverse or longitudinal directions. According to the drawing and loading conditions provided by the designer, the lateral load along the transverse direction is 11.9 kips at both north and south abutments, and 23.9 kips along the longitudinal direction only at the north abutment (no lateral loading at the south abutment along longitudinal direction).

Based on the subsoil condition, the anticipated movement is approximately on the order of 3/4" inch along the transverse direction at the south abutment. The estimated movement at the north abutment is relatively small, which is expected to be less than 1/4 inch along both transverse and longitudinal directions.

Bank Stability

The existing structures cross over San Leandro Creek. Based on the boring data and ground profile, the slope stability at the south bank appears to be more critical. Slope stability was analyzed under static, seismic and post-liquefaction conditions. For the seismic condition, the stability was analyzed by using pseudo-static analysis with a horizontal coefficient of 0.2g. For the post-liquefaction condition, residual shear strength of 300 psf is assumed for the liquefied sand. The estimated minimum Factor of Safety (F. S.) for global slope stability at the south bank is 2.46 for static condition, 1.58 for the seismic condition, and 1.63 for the post-liquefaction condition. It is our opinion that global slope stability at the project site is satisfactory for both north and south banks. Potential local slump may still be possible due to conditions that are not reviewed during this study. The results are presented in Appendix C of the report.

Seismic Design Criteria

Caltrans Seismic Design Criteria. Based on the seismic hazard map prepared by Mualchin (Caltrans, 1996), the governing faults for the structure is the Hayward Fault (a strike-slip fault, Mw=7.5) located at about 2 miles from the site. The anticipated Peak Bedrock Acceleration is 0.7g per Sadigh (1997). For seismic design, the recommended curve is based on Caltrans Seismic Design Criteria (Version 1.4, June 2006). The ARS Design Curve is presented on Plate 5A. The seismic design criteria are as follows:

1. Soil Profile D.
2. ARS Design Curve – Figure B.8 (Caltrans SDC v. 1.4) with the following modifications
    a) 20% increase of Sa for structural periods equal or greater than 1 second.
    b) No change for Sa for structural periods less than 0.5 second.
    c) Linear interpolation of Sa between 0.5 and 1 seconds.

California Building Code (2001). Based on the "Maps of Known Active Fault & Near-Source Zones " published by International Conference of Building Officials (February 1998), the governing faults at the site is the Hayward Fault (Type A fault, M_{max} = 7.1). The subsoil can be categorized as S_D according to the boring data. The relevant seismic coefficients are tabulated as follows:

SEISMIC DATA TABLE

Categorization / Coefficient	Design Value
Seismic Zone (Figure 16-2)	4
Seismic Zone Factor (Table 16-I)	0.4
Seismic Source Type (Table 16-U)	A
Near Source Factor Na (Table 16-S)	1.38
Near Source factor Nv (Table 16-T)	1.84
Seismic Coefficient Ca (Table 16-Q)	0.61
Seismic Coefficient Cv (Table 16-R)	1.18

Plan Review

We recommend that final plans for foundation upgrades be reviewed by this office prior to construction so that the intent of our recommendations is included in the project plans and specifications and to further see that no misunderstandings or misinterpretations have occurred.

Construction Observation

To a degree, the performance of any structure is dependent upon construction procedures and quality. Hence, observation of foundation excavations, pile installations should be carried out by the regulating agencies. If the subsurface conditions different from those forming the basis of our recommendations is encountered this office should be informed in order to assess the need for design changes. Therefore, the recommendations presented in this report are contingent upon good quality control and these geotechnical observations during construction.

INVESTIGATION LIMITATIONS

Our services consist of professional opinions and recommendations made in accordance with generally accepted geotechnical engineering principles and practices and are based on our site reconnaissance and the assumption that the subsurface conditions do not deviate from observed conditions. All work done is in accordance with generally accepted geotechnical engineering principles and practices. No warranty, expressed or implied, of merchantability or fitness, is made or intended in connection with our work or by the furnishing of oral or written reports or findings. The scope of our services did not include any environmental assessment or investigation for the presence or absence of hazardous or toxic materials in structures, soil, surface water, groundwater or air, below or around this site. Unanticipated soil conditions are commonly encountered and cannot be fully determined by taking soil samples and excavating test borings; different soil conditions may require that additional expenditures be made during construction to attain a

properly constructed project. Some contingency fund is thus recommended to accommodate these possible extra costs.

This report has been prepared for the proposed project as described earlier, to assist the engineer in the design of this project. In the event any changes in the design or location of the facilities are planned, or if any variations or undesirable conditions are encountered during construction, our conclusions and recommendations shall not be considered valid unless the changes or variations are reviewed and our recommendations modified or approved by us in writing.

This report is issued with the understanding that it is the designer's responsibility to ensure that the information and recommendations contained herein are incorporated into the project and that necessary steps are also taken to see that the recommendations are carried out in the field.

The findings in this report are valid as of the present date. However, changes in the subsurface conditions can occur with the passage of time, whether they be due to natural processes or to the works of man, on this or adjacent properties. In addition, changes in applicable or appropriate standards occur, whether they result from legislation or from the broadening of knowledge. Accordingly, the findings in this report might be invalidated, wholly or partially, by changes outside of our control.

Respectfully submitted,
PARIKH CONSULTANTS, INC.

Frank Y. Wang, P.E. C67751
Project Engineer

REGISTERED PROFESSIONAL ENGINEER
GAURANG R. PARIKH
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EXP. 12-31-09
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STATE OF CALIFORNIA

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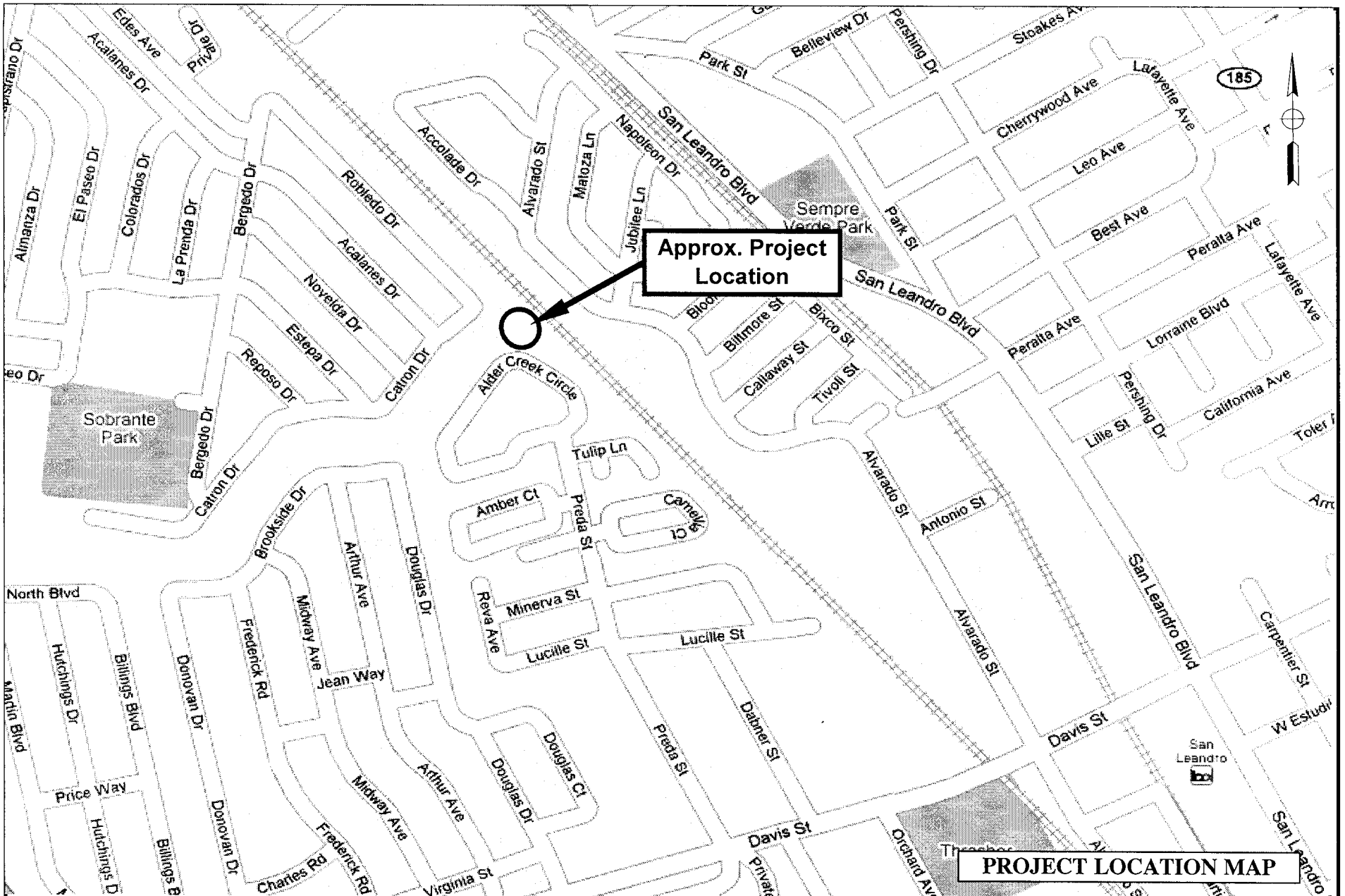
Project Manager



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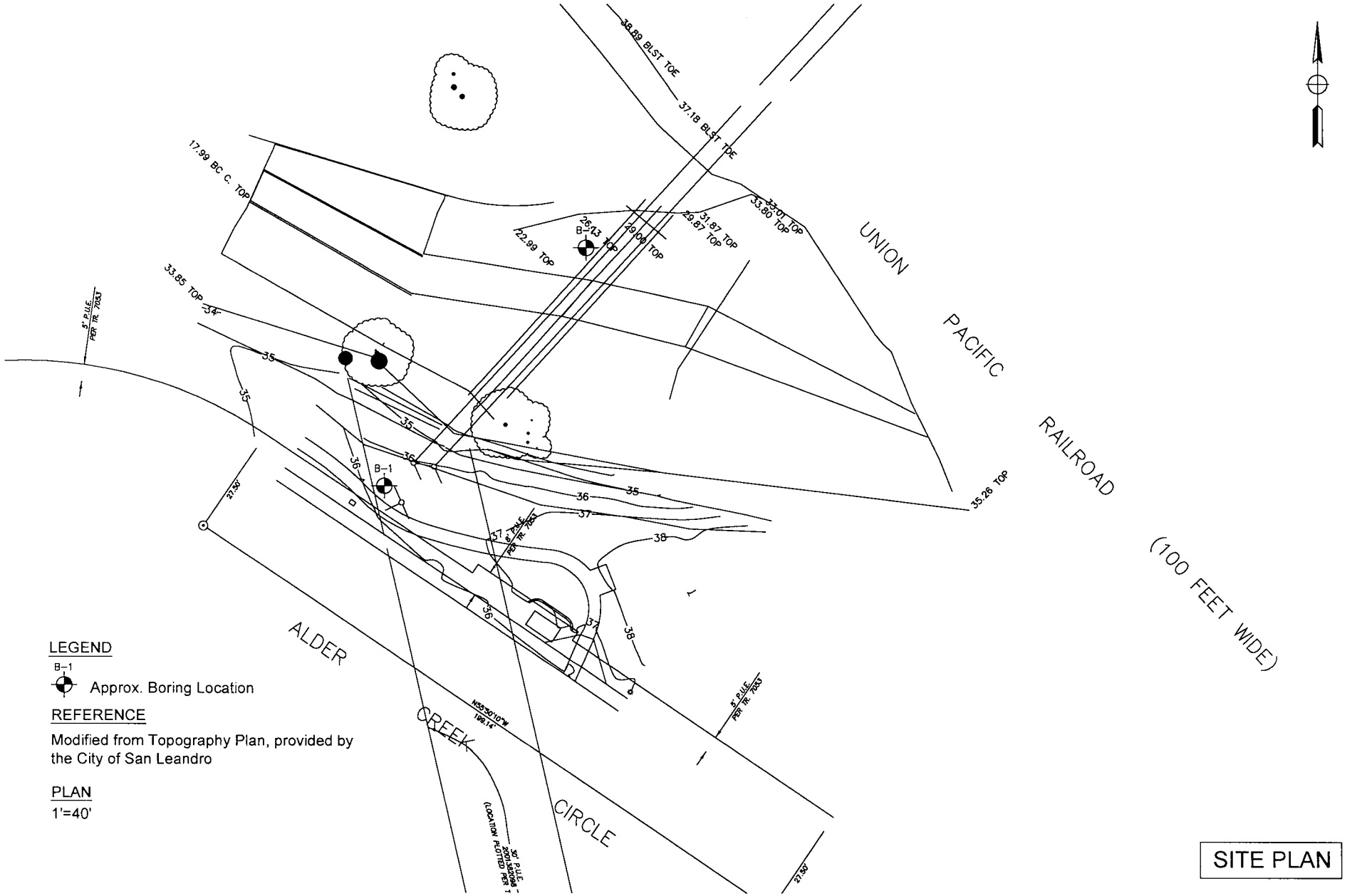
MATERIALS TESTING

PREDA STREET PIPE BRIDGES UPGRADE PROJECT
CITY OF SAN LEANDRO, CALIFORNIA

JOB NO.: 207144.10	PLATE NO.: 1



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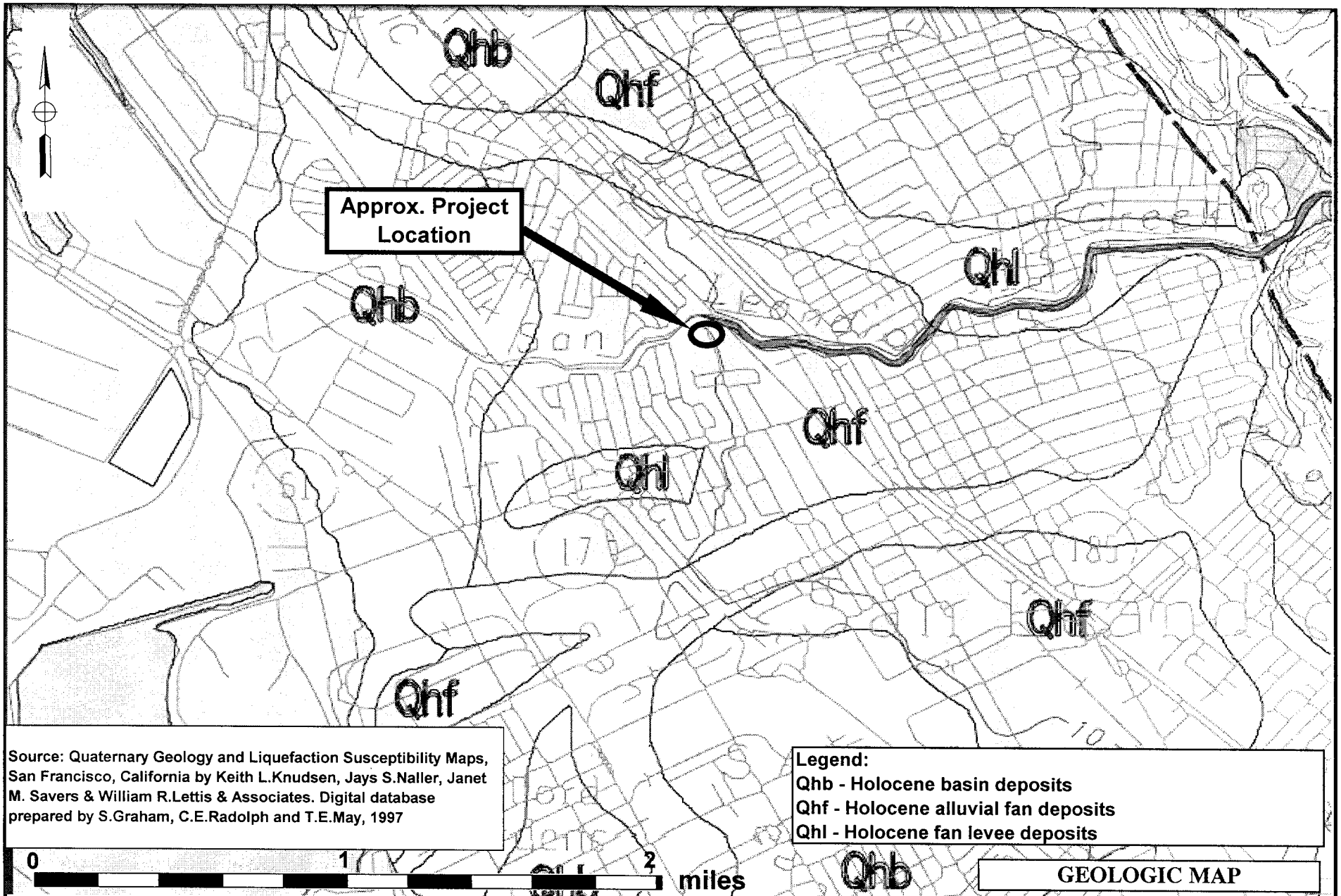
GEOTECHNICAL CONSULTANTS AND MATERIALS TESTING

PREDA STREET PIPE BRIDGES UPGRADE PROJECT
SAN LEANDRO, CALIFORNIA

JOB NO.: 207144.10

PLATE NO.: 2



Source: Quaternary Geology and Liquefaction Susceptibility Maps, San Francisco, California by Keith L.Knudsen, Jays S.Naller, Janet M. Savers & William R.Lettis & Associates. Digital database prepared by S.Graham, C.E.Radolph and T.E.May, 1997

Legend:
Qhb - Holocene basin deposits
Qhf - Holocene alluvial fan deposits
Qhl - Holocene fan levee deposits

GEOLOGIC MAP

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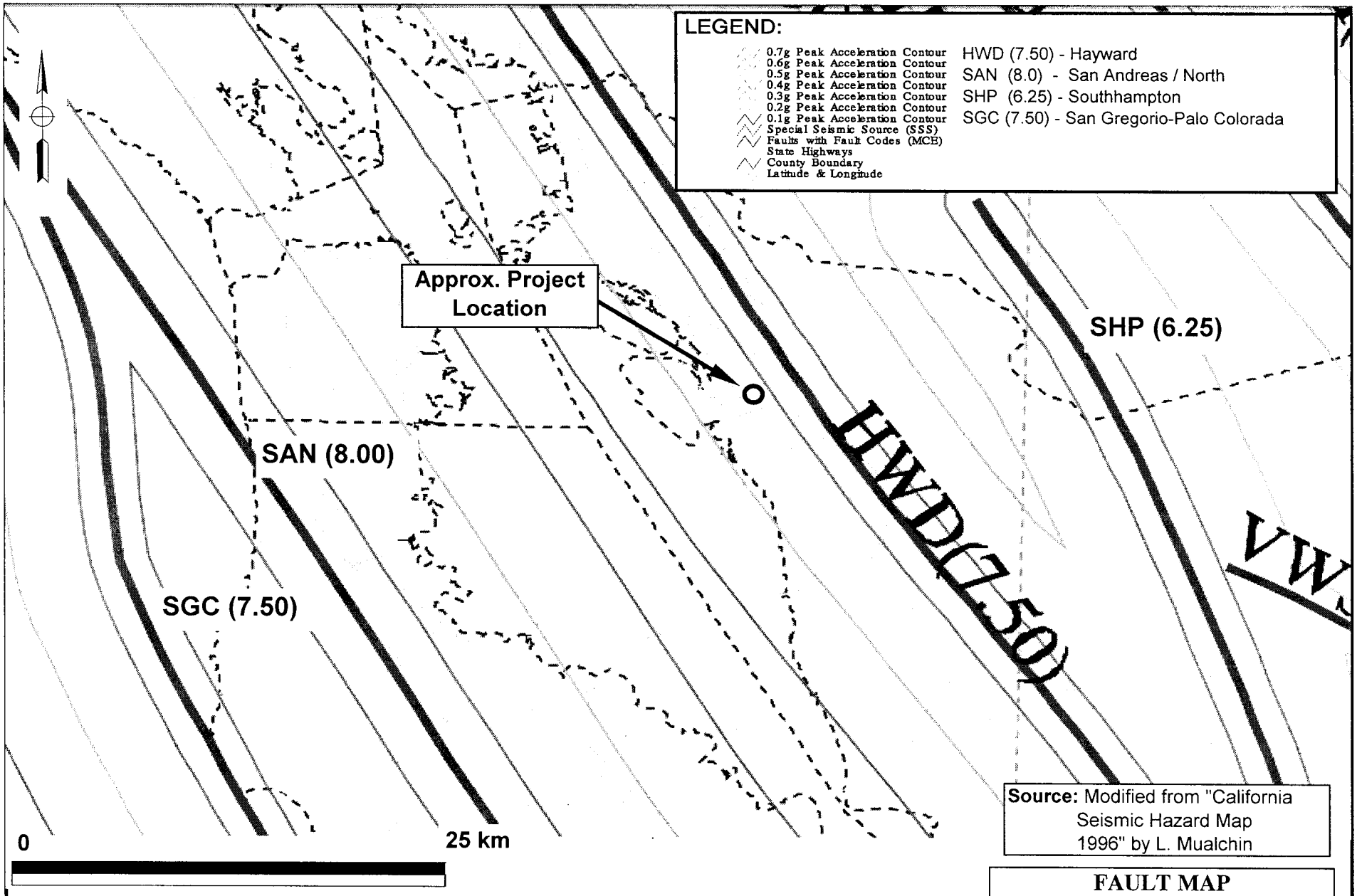
PREDA STREET PIPE BRIDGES UPGRADE PROJECT
CITY OF SAN LEANDRO, CALIFORNIA

JOB NO.: 207144.10

PLATE NO.: 3



Source: Modified from "California Seismic Hazard Map 1996" by L. Mualchin

FAULT MAP

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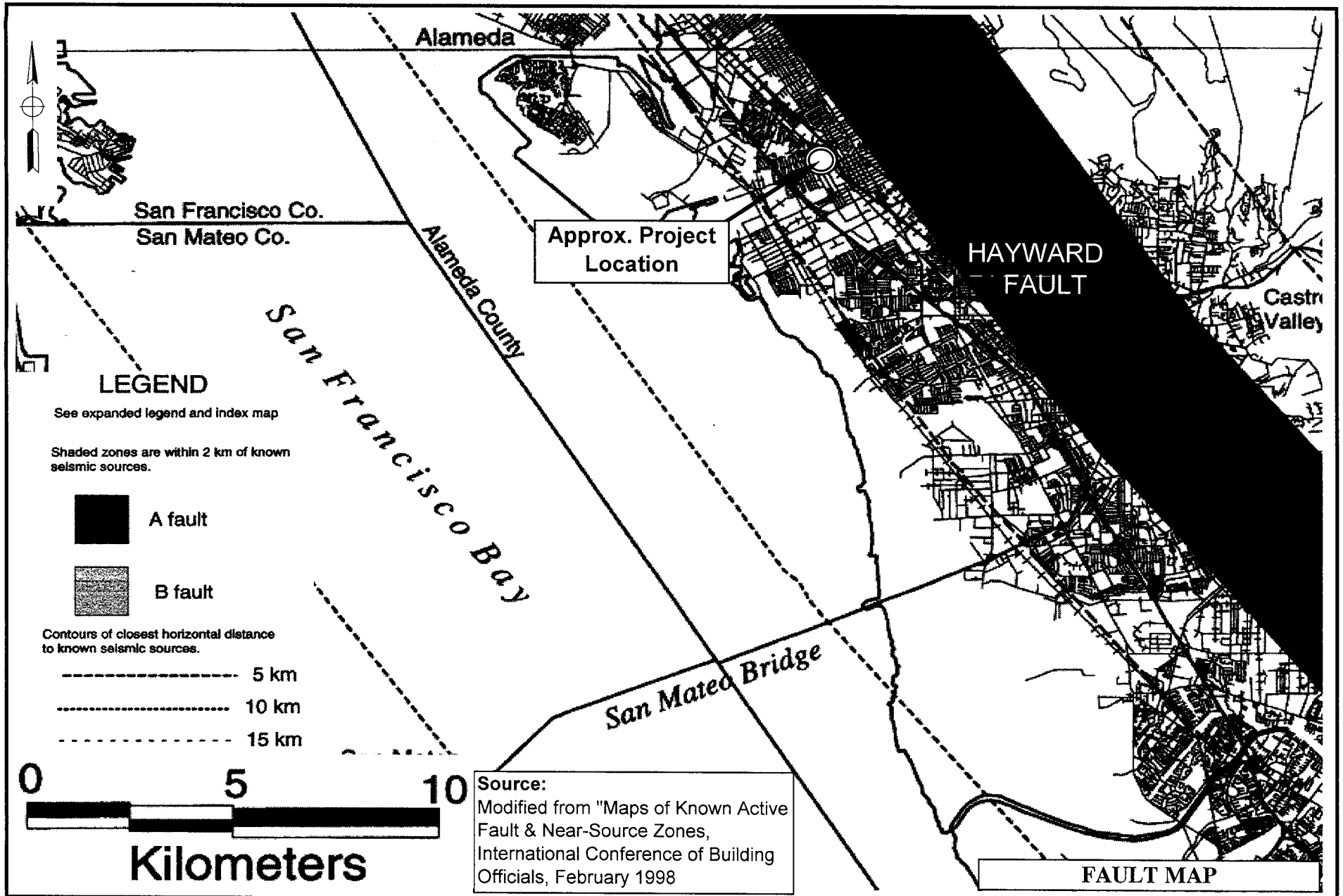
MATERIALS TESTING

PREDA STREET PIPE BRIDGES UPGRADE PROJECT
CITY OF SAN LEANDRO, CALIFORNIA

JOB NO.: 207144.10	PLATE NO.: 4A



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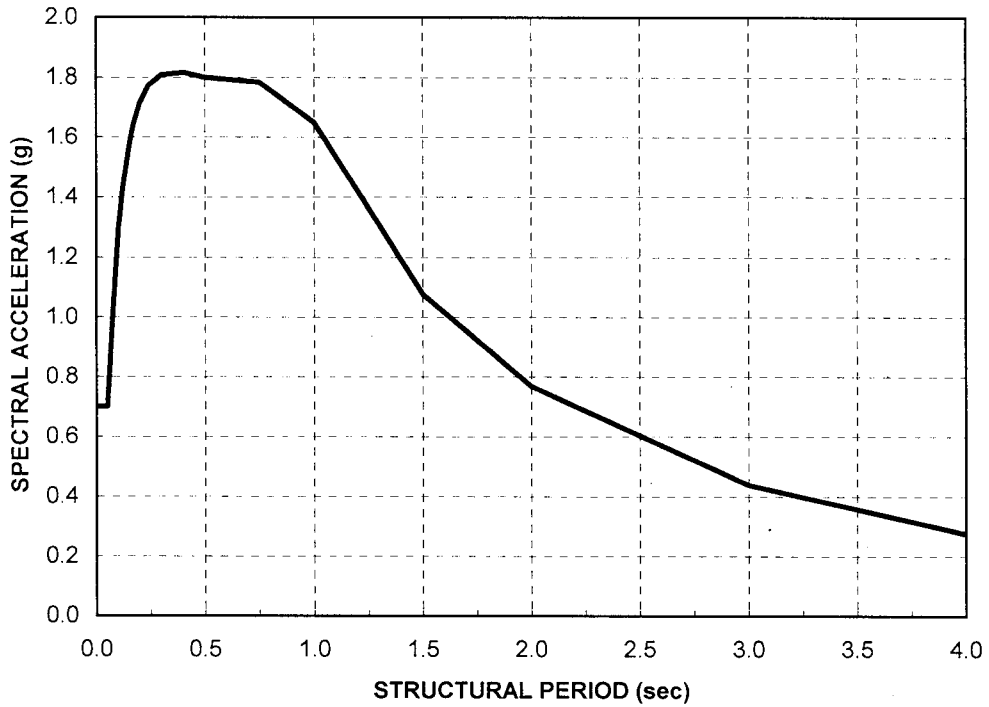
MATERIALS TESTING

PREDA STREET PIPE BRIDGES UPGRADE PROJECT
CITY OF SAN LEANDRO, CALIFORNIA

JOB NO.: 207144.10

PLATE NO.: 4B

ARS DESIGN CURVE (CALTRANS SDC V. 1.4)
PREDA STREET PIPE BRIDGES UPGRADE PROJECT
CITY OF SAN LEANDRO, CALIFORNIA

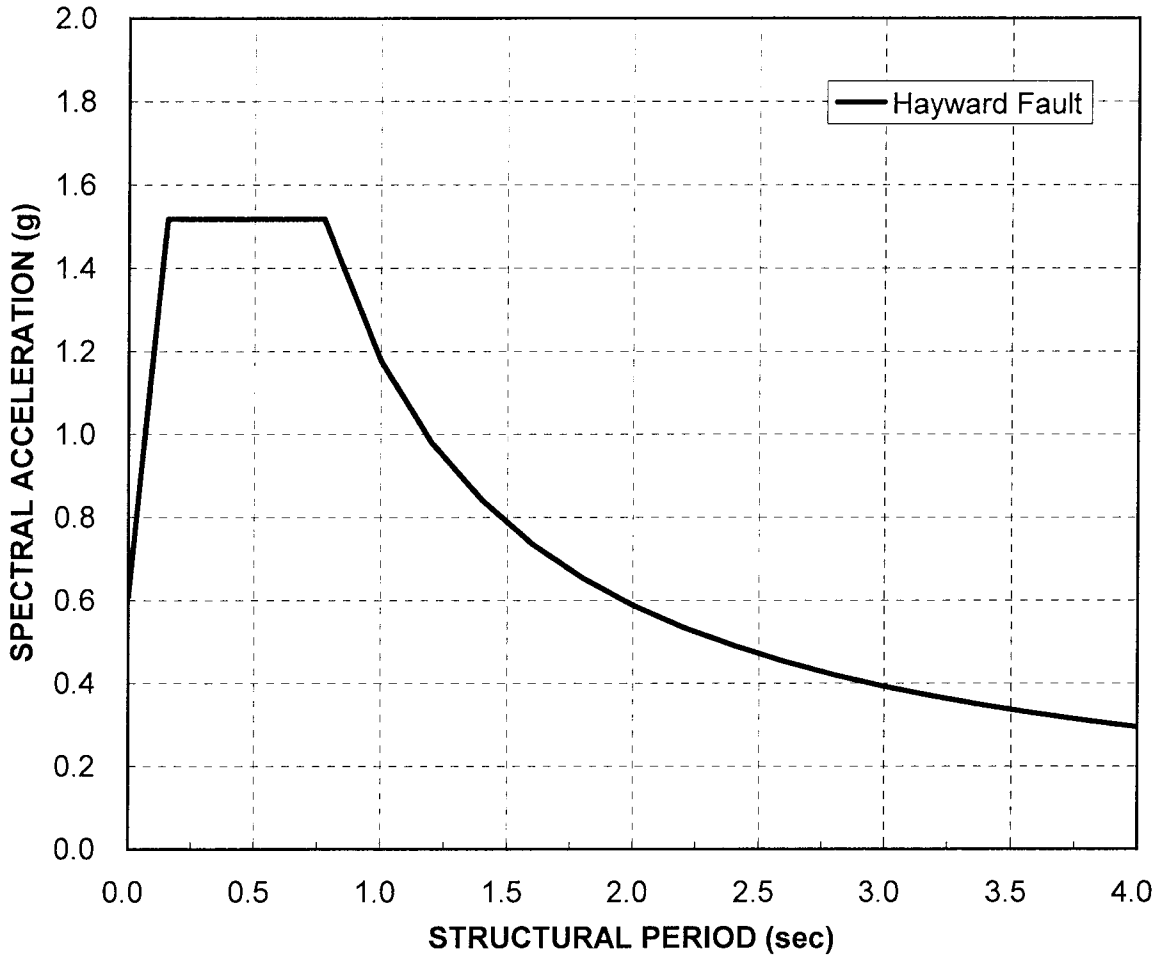


Spectral Data

Period (sec)	HWD (7.50) Spectral Accel. (g)
0.010	0.700
0.020	0.700
0.030	0.700
0.050	0.700
0.075	1.012
0.100	1.289
0.120	1.422
0.150	1.561
0.170	1.641
0.200	1.713
0.240	1.773
0.300	1.808
0.400	1.816
0.500	1.800
0.750	1.783
1.000	1.649
1.500	1.077
2.000	0.768
3.000	0.439
4.000	0.276

1. Caltrans SDC (v 1.4, June 2007), Figure B.8,
   Governing Fault: Hayward Fault
   (Mw = 7.50, Soil Profile Type D, PBA = 0.7g)
   with the following modifications:
   (1) No change of Sa for structural periods < 0.5 sec
   (2) 20% increase of Sa for structural periods ≥ 1 sec
   (3) Linear interpolation for structural periods between 0.5 and 1 sec

SEISMIC DESIGN RESPONSE SPECTRA
(CBC, 2001)
PREDA STREET PIPE BRIDGES
SAN LEANDRO, CALIFORNIA



Governing Fault: Hayward Fault (Mw=7.1)
Soil Profile: S_D (stiff soil, SPT-N between 15 and 50)

Reference: California Building Code (2001)

PARIKH CONSULTANTS, INC. GEOTECHNICAL CONSULTANTS MATERIALS TESTING	PREDA STREET PIPE BRIDGES UPGRADE PROJECT SAN LEANDRO, CALIFORNIA	
	JOB NO.: 207144.10	PLATE NO.: 5A

APPENDIX A

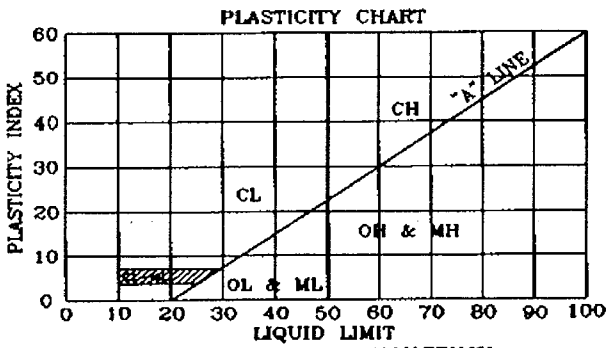
UNIFIED SOIL CLASSIFICATION SYSTEM

MAJOR DIVISIONS			GROUP SYMBOLS	ILLUSTRATIVE GROUP NAMES
COARSE-GRAINED SOILS More than 50% retained on No. 200 sieve	GRAVELS More than 50% of coarse fraction retained on No. 4 sieve	CLEAN GRAVELS Less than 5% fines	GW	Well graded gravel, Well graded gravel with sand
			GP	Poorly graded gravel, Poorly graded gravel with sand
		GRAVELS WITH FINES More than 12% fines	GM	Silty gravel, Silty gravel with sand
			GC	Clayey gravel, Clayey gravel with sand
	SANDS 50% or more of coarse fraction passing No. 4 sieve	CLEAN SANDS Less than 5% fines	SW	Well graded sand, Well graded sand with gravel
			SP	Poorly graded sand, Poorly graded sand with gravel
		SANDS WITH FINES More than 12% fines	SM	Silty sand, Silty sand with gravel
			SC	Clayey sand, Clayey sand with gravel
FINE-GRAINED SOILS 50% or more passing No. 200 sieve	SILTS AND CLAYS Liquid Limit less than 50%		ML	Silt, Sandy silt with gravel
			CL	Lean clay, Sandy lean clay with gravel
			OL	Organic clay, Sandy organic clay with gravel
	SILTS AND CLAYS Liquid Limit more than 50%		MH	Elastic silt, Sandy elastic silt with gravel
			CH	Fat clay, Sandy fat clay with gravel
			OH	Organic clay, Sandy organic clay with gravel
HIGHLY ORGANIC			PT	Peat, Highly organic silts

NOTE: 1. Coarse-grained soils receive dual symbols if: (a) their fines are CL-ML (e.g. SC-SM or GC-GM) or (b) they contain 5-12% fines (e.g. SW-SM, GP-GC, etc.). Fine-grained soils receive dual symbols if their limits plot in the hatched zone of the Plasticity Chart (CL-ML).

2. The table lists 30 out of a possible 110 Group Names, all of which are assigned to unique proportions of the constituent soils. Flow charts in ASTM D 2487-93 aid assignment of the Group Names.

PLASTICITY CHART



GRAIN SIZE CLASSIFICATION

CLASSIFICATION	US STANDARD SIEVE SIZE
BOULDERS	Above 12"
COBBLES	12" to 3"
GRAVEL Coarse Fine	 3" to 3/4" 3/4" to No. 4
SAND Coarse Medium Fine	 No. 4 to No. 10 No. 10 to No. 40 No. 40 to No.200
SILT & CLAY	Below No. 200

COHESIVE SOIL CONSISTENCY

CLASSIFICATION	UNCONFINED COMP. STRENGTH (psf)
Very Soft	< 500
Soft	500 - 1000
Medium(Firm)	1000 - 2000
Stiff	2000 - 4000
Very Stiff	4000 - 8000
Hard	> 8000

COHESIONLESS SOIL RELATIVE DENSITY

CLASSIFICATION	SPT BLOW COUNTS (Blows/ft)
Very Loose	< 4
Loose	5 to 10
Medium Dense	11 to 30
Dense	31 to 50
Very Dense	> 50

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MATERIALS TESTING

PREDA STREET PIPE BRIDGES UPGRADE PROJECT
CITY OF SAN LEANDRO, CALIFORNIA

JOB NO.: 207144.10 | PLATE NO.: A-1A

Boring Location, Elevation & Date Drilled:	Drilling Method:	BORING NUMBER **LEGEND**
	Sampling Method:	Sheet 1 of 1

Sample Type & No.	Dry Density (pcf)	Water Content (%)	Blows Per Foot	Compress. Strength (tsf)	Depth (ft) Soil Graph & U.S.C.S.		
					0	Compressive strength as measured by Pocket Penetrometer, in tsf.	pp=1.0tsf
C-1			22			2 inch I.D. California Sampler (C).	
MC-2	110	12	23	1.2	5	2-1/2 inch I.D. Modified California Sampler (MC).	
SH-3	98	28	100 psi	0.8		3.5-inch I.D. Pitcher Tube Sampler (Cored).	
					10		
SPT-4	-	10	35	-		1-3/8 inch I.D. Standard Splitspoon Sampler (SPT).	
					15		
HS-5	95	20		0.7		1.9 inch I.D. Hand Sampler driven with a slide hammer.	
						Groundwater level first encountered during drilling	
					20	Groundwater level at completion of boring	
BULK-6	-	12				Bulk sample stored in plastic bag.	
						Liquid Limit (LL), in percent Plasticity Index (PI), in percent	LL=30 PI=10
NX-3	-	-		12.0	25		
						NX Core.	
						Consolidation Test	CN
						Percent gravel and coarser in sample,(+#4) Percent fines (silt/clay) in sample, (-#200)	+#4=20% -#200=50%
					30	Triaxial Test	TX

LEGEND FOR LOG OF BORING

PARIKH CONSULTANTS, INC.
Geotechnical & Materials Engineering

PREDA STREET PIPE BRIDGES UPGRADE PROJECT
CITY OF SAN LEANDRO, CA

Date: 11/2007 | Job No.: 207144.10

This log is part of the report prepared by Parikh Consultants, Inc. for the named project and should be read together with that report for complete interpretation. This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.

Plate: A-1B

LEGEND LEGEND.GPJ 1-3-08

Boring Location, Elevation & Date Drilled:	Drilling Method:	BORING NUMBER
SEE SITE PLAN; Elev. approx. 25.0 ft.; drilled on 11-2-07	3.5-inch dia. SOLID STEM AUGER MINUTEMAN	**B-1**
	Sampling Method: 2 1/2" I.D. Mod. Cal. (MC), 1 3/8" I.D. Std. Pen., 140 lbs hammer, 30 inch drop.	Sheet 1 of 2

Sample Type & No.	Dry Density (pcf)	Water Content (%)	Blows Per Foot	Compress. Strength (tsf)	Depth (ft) Soil Graph & U.S.C.S.			
					0			
1	92.8	28	13				LEAN CLAY WITH GRAVEL (CL), stiff, brown, moist, trace roots (FILL)	
						CL		
					5			
2	107.3	17	39	4.4			LEAN CLAY (CL), very stiff, dark brown, moist, trace roots	LL=42, PI=24
3	-	17	21				--very stiff	
					10		--increasing sand	
						SM	SILTY SAND WITH GRAVEL (SM), loose, yellowish brown, dry to moist	
4	103.1	16	17					
5	-	19	9			CL	LEAN CLAY (CL), stiff, yellowish brown, moist	
					15			
6	96.5	26	15	0.5			--stiff	
					▽ 20			
7	-	-	17				--stiff (No recovery)	
8	-	30	36				--hard, medium plasticity	
					25			
9	-	21	41				--very stiff, some sand	
					30			

LOG OF BORING

PARIKH CONSULTANTS, INC.
Geotechnical & Materials Engineering

PREDA STREET PIPE BRIDGES UPGRADE PROJECT
CITY OF SAN LEANDRO, CALIFORNIA

Date: 11/2007 | Job No.: 207144.10

This log is part of the report prepared by Parikh Consultants, Inc. for the named project and should be read together with that report for complete interpretation. This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.

Plate: A-2A

LB 207144.10.GPJ 1-4-08

Boring Location, Elevation & Date Drilled:	Drilling Method:	BORING NUMBER
SEE SITE PLAN; Elev. approx. 25.0 ft.; drilled on 11-2-07	3.5-inch dia. SOLID STEM AUGER MINUTEMAN	**B-1**
	Sampling Method: 2 1/2" I.D. Mod. Cal. (MC), 1 3/8" I.D. Std. Pen., 140 lbs hammer, 30 inch drop.	Sheet 2 of 2

Sample Type & No.	Dry Density (pcf)	Water Content (%)	Blows Per Foot	Compress. Strength (tsf)	Depth (ft) Soil Graph & U.S.C.S.	
					30	
10	87.3	33	18	0.6		--stiff
						Bottom of the hole at 31.5 feet. Groundwater encountered during drilling at 19.5 feet.
					35	
					40	
					45	
					50	
					55	
					60	

LOG OF BORING

PARIKH CONSULTANTS, INC.
Geotechnical & Materials Engineering

PREDA STREET PIPE BRIDGES UPGRADE PROJECT
CITY OF SAN LEANDRO, CALIFORNIA

Date: 11/2007 | Job No.: 207144.10

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Plate: A-2B

LB 207144.10.GPJ 1-4-08

Boring Location, Elevation & Date Drilled: SEE SITE PLAN; Elev. approx. 32.0 ft.; drilled on 11-8-07	Drilling Method: 3.5-inch dia. SOLID STEM AUGER MINUTEMAN	BORING NUMBER **B-2**
	Sampling Method: 2 1/2" I.D. Mod. Cal. (MC), 1 3/8" I.D. Std. Pen., 140 lbs hammer, 30 inch drop.	Sheet 1 of 2

Sample Type & No.	Dry Density (pcf)	Water Content (%)	Blows Per Foot	Compress. Strength (tsf)	Depth (ft)	Soil Graph & U.S.C.S.			
					0		SM		
1	-	7	13					SILTY SAND WITH GRAVEL (SM), loose, light brown, dry to moist, trace roots (FILL)	<#200=31%
					5				
2	98.0	11	40					--medium dense	
3	-	5	13				CL ML	SILTY CLAY (CL-ML), stiff, light brown, moist	
							GW GC	WELL GRADED GRAVEL WITH CLAY (GW-GC) Machine chattered	
					10				
4	95.7	35	19	1.0			CH	FAT CLAY (CH), stiff, light brown and mottled red, moist, medium to high plasticity	LL=55, PI=27
5	42.1	33	9		▽			--stiff	
					15		CL		
6	107.3	23	15					LEAN CLAY WITH GRAVEL(CL), stiff, light brown, wet, gravel size up to 1"	
					20		SM		
7	107.5	23	15					SILTY SAND (SM), loose, yellowish brown, wet	>#4=0% <#200=37.6%
					25				
8	122.0	18	40					--dense, trace gravel up to 0.5"	
					30		CL		

LOG OF BORING

PARIKH CONSULTANTS, INC.
Geotechnical & Materials Engineering

PREDA STREET PIPE BRIDGES UPGRADE PROJECT
CITY OF SAN LEANDRO, CALIFORNIA

Date: 11/2007 | Job No.: 207144.10

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Plate: A-3A

LB 207144.10.GPJ 1-4-08

Boring Location, Elevation & Date Drilled:	Drilling Method:	BORING NUMBER
SEE SITE PLAN; Elev. approx. 32.0 ft.; drilled on 11-8-07	3.5-inch dia. SOLID STEM AUGER MINUTEMAN	**B-2**
	Sampling Method:	Sheet 2 of 2
	2 1/2" I.D. Mod. Cal. (MC), 1 3/8" I.D. Std. Pen., 140 lbs hammer, 30 inch drop.	

Sample Type & No.	Dry Density (pcf)	Water Content (%)	Blows Per Foot	Compress. Strength (tsf)	Depth (ft) Soil Graph & U.S.C.S.	
					30	
9	-	23	14			LEAN CLAY (CL), stiff, light brown, wet
						Bottom of the hole at 31.5 feet. Groundwater encountered during drilling at 19.5 feet.
					35	
					40	
					45	
					50	
					55	
					60	

LOG OF BORING

PARIKH CONSULTANTS, INC.
Geotechnical & Materials Engineering

PREDA STREET PIPE BRIDGES UPGRADE PROJECT
CITY OF SAN LEANDRO, CALIFORNIA

Date: 11/2007 | Job No.: 207144.10

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Plate: A-3B

APPENDIX B

APPENDIX B
LABORATORY TESTS

Classification Tests

The field classification of the samples was visually verified in the laboratory according to the Unified Soil Classification System (ASTM Test Method D 2488, Visual-Manual Procedure). The classification has been verified with laboratory data as necessary. The classification tests are presented on "Log of Test Borings", Appendix A.

Moisture-Density

The natural moisture contents and dry unit weights were determined for selected undisturbed samples of the soils in general accordance with ASTM Test Method D 2216-92. This information was used to classify and correlate the soils. The results are presented at the appropriate depths on the "Log of Test Borings", Appendix A.

Unconfined Compression Tests

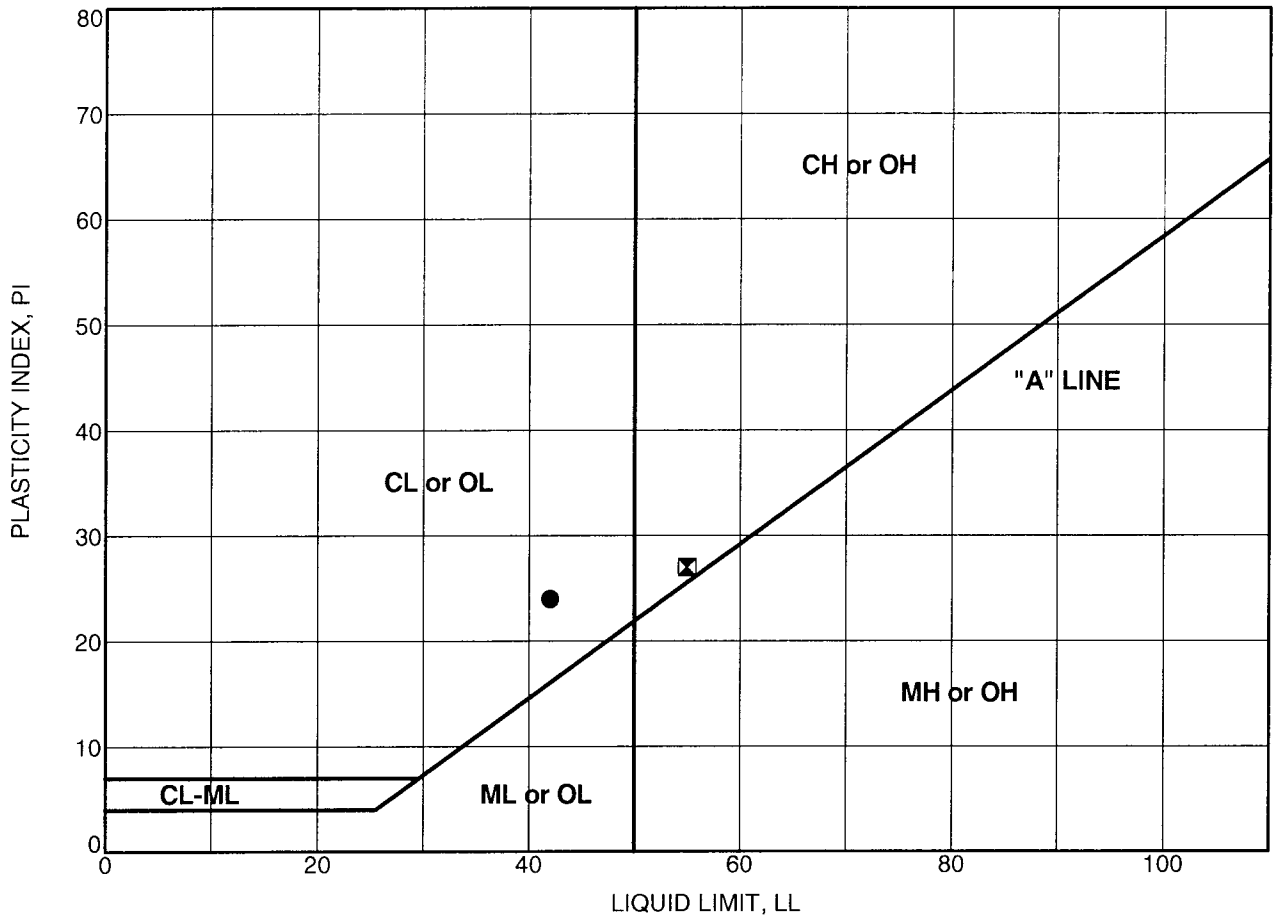
Strength tests were performed on selected undisturbed sample using unconfined compression machine. Unconfined compression test was performed in general accordance with California Test Method T 221. The results are presented on "Log of Test Borings".

Atterberg Limits

The Atterberg Limits were determined for selected samples of the fine-grained materials. These results were used to classify the soils, as well as to obtain an indication of the effective strength characteristics and expansion potential with variations in moisture content. The Atterberg Limits were determined in general accordance with ASTM Test Method D 4318-93. The results of these tests are presented on Plate B-2, "Plasticity Chart".

Grain Size Classification

Grain size classification tests (ASTM Test Method D 422-63) were performed on selected samples of granular soil to aid in the classification. The results are presented on Plate B-3, "Grain Size Distribution Curves".



PLASTICITY CHART

Boring Number	Sample Number	Depth (feet)	Test Symbol	Moisture Content (%)	LL	PL	PI	Description
B-1	MC-2	6.0	●	17	42	18	24	LEAN CLAY (CL)
B-2	MC-4	11.0	⊠	35	55	28	27	FAT CLAY (CH)

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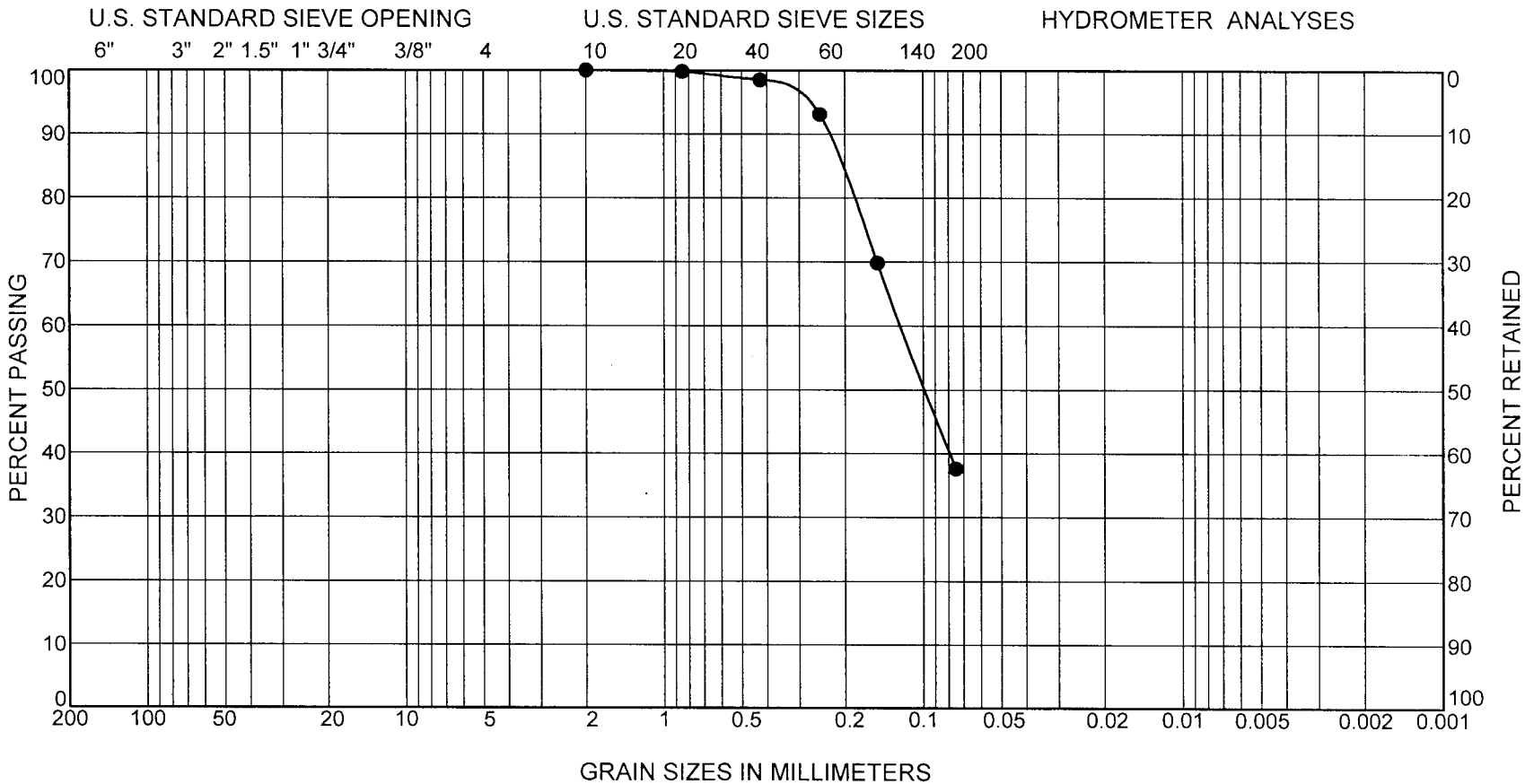
PREDA STREET PIPE BRIDGES UPGRADE PROJECT
CITY OF SAN LEANDRO, CALIFORNIA

JOB NO: 207144.10

PLATE NO: B-2

GRAIN SIZE DISTRIBUTION CURVES

COBBLES	GRAVEL		SAND			SILT AND CLAY
	coarse	fine	coarse	medium	fine	



Boring Number	Sample Number	Depth (feet)	Symbol	LL	PI	Description
B-2	MC-7	21.0	●			SILTY SAND (SM)

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PREDA STREET PIPE BRIDGES UPGRADE PROJECT
CITY OF SAN LEANDRO, CALIFORNIA

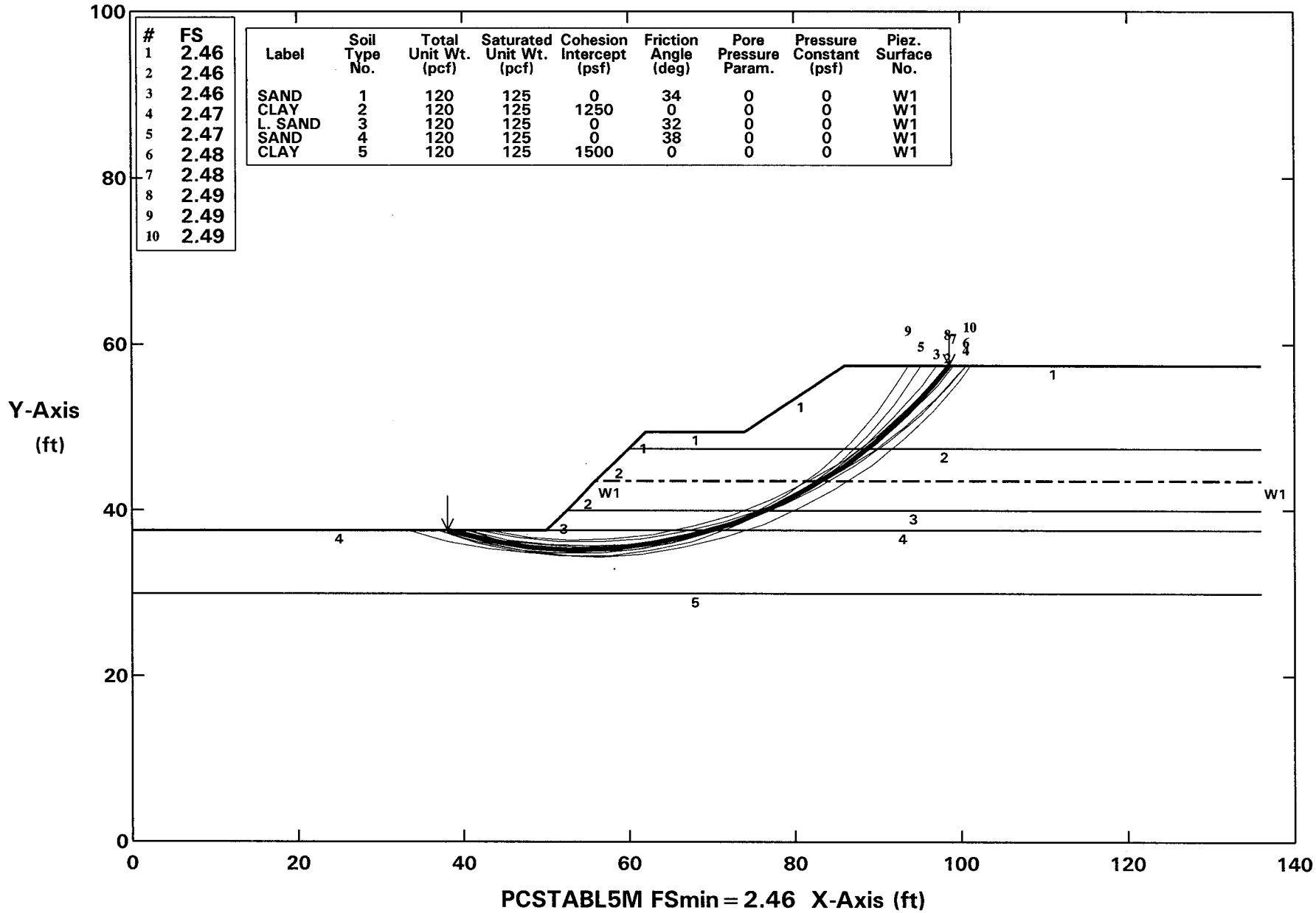
JOB NO: 207144.10

PLATE NO: B-3

APPENDIX C

PREDA STREET PIPE BRIDGES, SAN LEANDRO, CA (STATIC CONDITION)

Ten Most Critical. C:PREDA.PLT By: FYW 01-04-08 5:58pm



#	FS
1	2.46
2	2.46
3	2.46
4	2.47
5	2.47
6	2.48
7	2.48
8	2.49
9	2.49
10	2.49

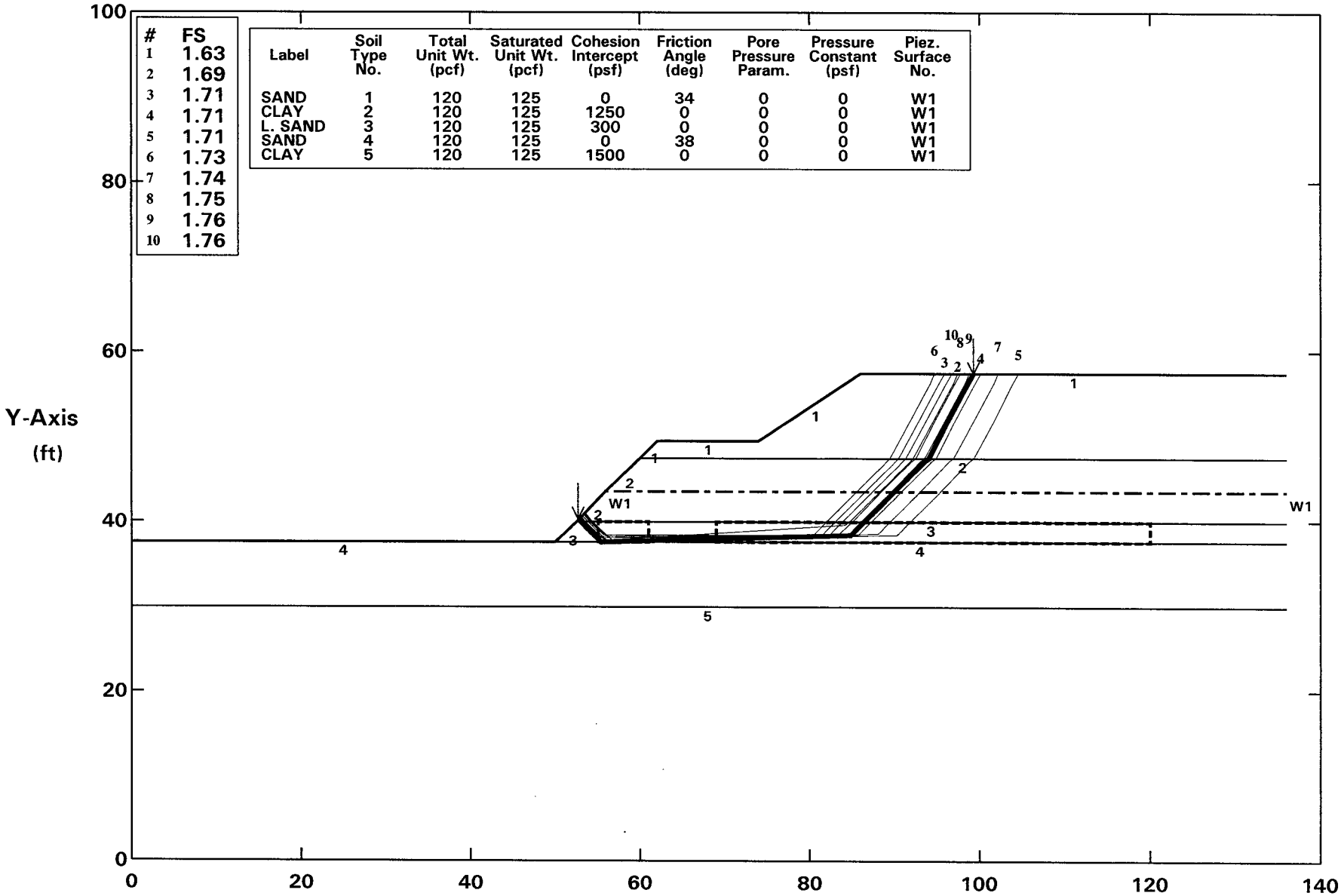
Label	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
SAND	1	120	125	0	34	0	0	W1
CLAY	2	120	125	1250	0	0	0	W1
L. SAND	3	120	125	0	32	0	0	W1
SAND	4	120	125	0	38	0	0	W1
CLAY	5	120	125	1500	0	0	0	W1

PREDA STREET PIPE BRIDGES, SAN LEANDRO, CA (POST-LIQUEFACTION)

Ten Most Critical. C:PREDA.PLT By: FYW 01-03-08 10:01am

#	FS
1	1.63
2	1.69
3	1.71
4	1.71
5	1.71
6	1.73
7	1.74
8	1.75
9	1.76
10	1.76

Label	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
SAND	1	120	125	0	34	0	0	W1
CLAY	2	120	125	1250	0	0	0	W1
L. SAND	3	120	125	300	0	0	0	W1
SAND	4	120	125	0	38	0	0	W1
CLAY	5	120	125	1500	0	0	0	W1



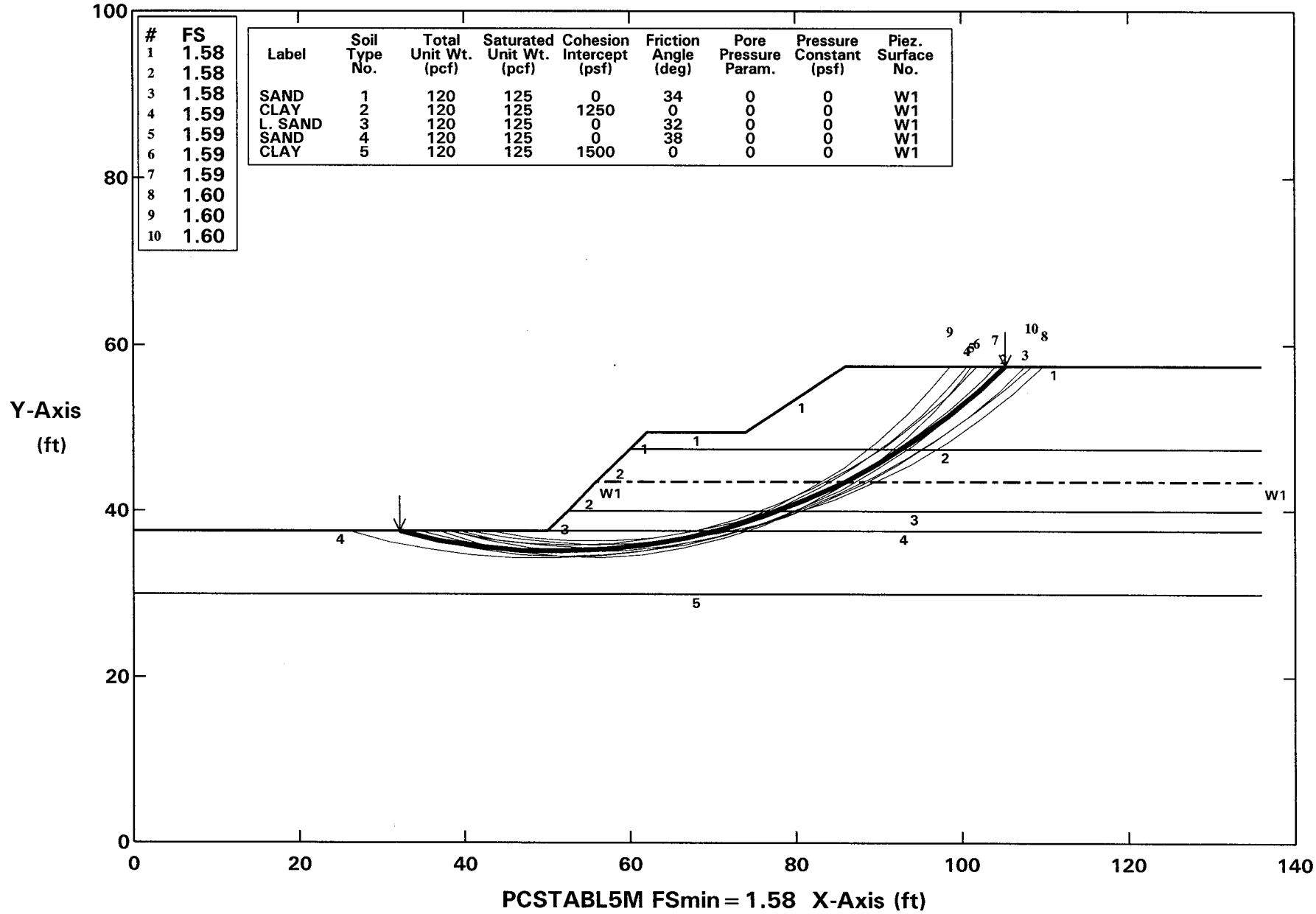
PCSTABL5M FSmin = 1.63 X-Axis (ft)

PREDA STREET PIPE BRIDGES, SAN LEANDRO, CA (SEISMIC, 0.2g)

Ten Most Critical. C:PREDA.PLT By: FYW 01-03-08 10:06am

#	FS
1	1.58
2	1.58
3	1.58
4	1.59
5	1.59
6	1.59
7	1.59
8	1.60
9	1.60
10	1.60

Label	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
SAND	1	120	125	0	34	0	0	W1
CLAY	2	120	125	1250	0	0	0	W1
L. SAND	3	120	125	0	32	0	0	W1
SAND	4	120	125	0	38	0	0	W1
CLAY	5	120	125	1500	0	0	0	W1



PCSTABL5M FSmin = 1.58 X-Axis (ft)